c. The conversion of the medullary substance into a vascular connective tissue containing fat cells, giant cells, and leucocytes. In a small proportion of the reported cases cysts filled with gelatinous material and giant-celled sarcomata occur in the medulla.

d. As a consequence of these three processes, the ordinary relations of the compact substance and medulla are destroyed. The bones become exceedingly thickened and asymmetrical, but since the new bone tissue remains uncalcified its elasticity permits of great deformity of the long bones from the weight of the body, and fractures do not occur.

2. The whole picture of osteitis deformans from its pathological aspect is so very characteristic that it must be considered a distinct disease, and its pathological diagnosis is correspondingly easy.

3. The etiology of the condition is as obscure as when Paget first described it. Some predisposing tendency, probably trophic, must be assumed, and the exciting cause may be mechanical; in the skull, extremes of heat and cold, and in the vertebra and long bones the ordinary traumata to which these bones are exposed. Lesions of the nervous system are inconstant and rare, and are probably not a causal factor.

ASYMMETRY OF THE NASAL CAVITIES.[1]

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In this community at least asymmetry of the nasal passages, to a greater or less degree, is so common that it might almost be considered the rule rather than the exception. It is found in those persons who practically never suffer from any disturbance of nasal function as well as in the patients in our clinics. It has been shown by Harrison Allen that asymmetry of the nasal passages may exist without deflection of the septum, but in the great majority of cases a deviation of the septum is the most prominent feature of the asymmetry. The etiology of these deviations, the forms which they may take, their frequency among different races, have been so often and so completely described that I need simply refer to papers by Ingals, Delavan, Bosworth, MacKenzie, Harrison Allen, and Roe, and to the works of Morrell McKenzie, Welcker, Ziem, Stoker, Rosenthal, Sendziac, McDonald, Collier, and especially Zuckerkandl.

In the literature of the subject of deviations of the septum and of asymmetry of the nasal fossæ are frequent references to changes in the shape of the turbinated bodies, commonly found in connection with these deviations. Of these, the most noticeable is an enlargement of the turbinates opposite the concavity of the septum. Considering the large amount that has been written about the asymmetries of the septum, it is perhaps strange that more attention has not been given to these coincident asymmetries of the other intranasal structures. It is commonly observed that in cases of deflection of the septum the turbinated body opposite a concavity is enlarged and the one opposite the convexity is small. This readjustment is formed partly by changes in size or in shape of the bones, and completed by the soft parts. Not only is the turbinated body as a whole enlarged, or contracted, but localized projections from the septum, as a spur or ridge, may be accompanied by a localized depression in the turbinate opposite to it. By examination of skulls it is evident that these changes are not confined to the turbinates, but often include the ethmoid cells, and sometimes the walls of the maxillary antra.

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[1] Read before the American Laryngological Association, 1901.

The etiology of these asymmetries has received the attention of several writers, with varying results. In brief, the causes assigned come under one of three heads: First, that the deviation of the septum is primary, and the accompanying changes in the turbinates are due either to changes brought about by the inspired air current, or to pressure on the turbinate. Second, that deviation of the septum is secondary, caused by a primary change in the shape of the turbinates. Third, that both the deflected septum and the asymmetrical turbinates and outer wall are due to a common asymmetrical development. The enlarged turbinate is sometimes referred to as an accidental pathological hypertrophy, but often it is looked upon as compensatory—as helping to fill up a cavity which would otherwise be too open.

Nineteen years ago Delavan, in a paper on "The Question of Hypertrophy of the Osseous Structure of the Turbinated Bodies," discussed the hypertrophy of bone as well as of soft parts, especially in connection with deflected septa. I do not know that there is to-day a better argument on that subject. He points out the peculiar intimate relations between the mucous membrane of the turbinated body and the bone, and concludes that "the conditions favorable to the hypertrophy of the turbinated bone would seem to be (1) unusual space in the nasal fossæ; (2) long-continued hyperæmia of the structures investing the bone; (3) the existence of the above conditions during the period of greatest constructive activity."

Bosworth says: "It is necessary for the development of these hypertrophic changes that air should pass through the fossa. We, therefore, find it an invariable rule that the greatest extent of hypertrophy develops on that side which is most open, for in no case of a deflected septum is the extra width of one passage competent to supply the deficiency of the other."

Bryan, while following Bosworth's view of the influence of the air tension in producing hypertrophy, protests that it seems overdrawn. Greville McDonald considers that there is both a true hypertrophy and an engorgement of the inferior turbinated body, and that it would appear to be a physiological attempt to compensate for the abnormal width of the fossa, and should not be lightly interfered with.

Lennox Browne regards the hypertrophy as compensatory rather than as simply pathological. He says: "Deflections, while causing stenosis of the meatus into which they protrude, naturally increase the patency of the opposite side; but increase of function is apt to render the turbinated bodies on this open side liable to compensatory hypertrophy. This secondary overgrowth or vascular turgescence may take place to such an extent that stenosis will be produced, which will demand treatment; but it often happens that a deviated septum having been rectified, the compensatory hypertrophy of the turbinals of the opposite side will spontaneously undergo partial and sufficient resolution."

Roe points out that as the air in respiration should be equally divided between the two sides, the hypertrophy may be a compensation of nature for this extra work. He says: "The hypernutrition has been caused by the irritation consequent upon the excessive amount of air passing through the unobstructed passage."

Ziem, in 1883, traced a connection between unilateral nasal obstruction and nasal and facial asymmetry. By obstructing one nasal passage in young animals he concluded that the restriction of respiration retards, and functional activity increases, the development of the nasal structures.

During the last few years renewed attention has been directed toward the influence of a restriction of the normal air current on the development of the bones of the face and nasal passages. It has long been very commonly accepted that adenoid hypertrophy in the vault, by restricting respiration, is the principal cause of certain peculiarities in the development of the facial bones. This has, to a greater or less extent, been doubted or denied, especially in the last five years, by Fränkel, Siebenmann, and Grossheinz, who conclude that the high arch and narrow face are together forms of skull development independent of nasal stenosis. So far as normal development is dependent upon normal function, we should expect asymmetrical development in cases of unilateral obstruction to respiration.

An interesting study is offered by certain reported cases of congenital occlusion of the posterior nares by a bony plate. In some of these cases the occlusion was unilateral, in others bilateral. The patients had lived since birth with absolutely no passage of air through one or both nasal passages.

An extreme advocate of the influence of the air current as the causative factor in abnormal development of these bones should expect to find symmetry, but extreme high palate in cases of bilateral occlusion and marked asymmetry where the occlusion was unilateral. That such is seldom the case shows that other elements must be considered. In most of the reported cases, although the facial and nasal index have been carefully measured, I have not been able to find very satisfactory descriptions of the relations of the turbinates to the deflections of the septum. I have myself seen two cases of choanal occlusion, one bilateral, the other unilateral.

The first case, bilateral, has been reported by Clark. A girl, aged eighteen years, had been unable to breathe through the nose at all since birth, on account of the complete occlusion of both posterior nares by bony plates. The septum was markedly deflected to the left, forming a concavity in the right nasal chamber. The right lower turbinated bone was enlarged and projected toward the concavity. On the left side there was a ridge on the septum and a small and retracted turbinated body.

The second case was a Swedish girl, a domestic, aged eighteen years. I first saw her in September, 1897. She had never been able to breathe through the right nostril. She breathed easily through the left side, and was not obliged to open her mouth except on exertion. The posterior rhinoscopic mirror showed a normal choana on the left; on the right was a smooth surface, with no visible line separating it from the vault or from the septum. This was a bony plate, which I subsequently removed. There was no marked high arching of the palate, nor facial asymmetry. The left nasal cavity was normal, except that the septum was deflected to a moderate extent into this side, with a corresponding concavity in the occluded right side. The lower turbinate in the left side was retracted, leaving good space for respiration. In the right side the lower turbinate bulged toward the concavity to an extent which made it slightly difficult to reach the obstruction with straight instruments. The soft parts of the turbinated body were somewhat pale and collapsed, but the bone in general followed the curve of the septum.

Haag has collected the reports of 44 cases of occlusion of the choanæ, of which 20 were bilateral and 16 right-sided and 8 left-sided. In only 3 of the unilateral cases was there marked facial asymmetry. In 1 of these the septum was straight and the nasal passages were of equal size. In 5 of the unilateral cases the septum deviates toward the occluded side. In the others it is either normal or not mentioned. In 1 bilateral case there was facial asymmetry, and in at least 2 deviation of the septum. Subsequently, Morf and Baurowicz have reported cases with the same conclusions. In many of the cases reported the turbinates in the obstructed nasal cavities were normal except that they appeared pale.

These cases tend to prove that the influence of the respiratory air current, or functional activity, on the development, or on pathological changes in shape of the intranasal structures, is at least limited. In a case reported by Dr. C. H. Knight, in 1888, and in similar ones by Schoetz, Anton, and Simon, of unilateral occlusion, the concave side and the large turbinate were found on the unobstructed side. Here it might be argued that the hypertrophy was caused by the air current, but in most of them the deflection was slight, and the single nasal passage admitted sufficient air for nasal respiration. In my case the septum was deflected toward the unobstructed side.

That the adjustment of the turbinates may be due to the increased or diminished space in the nasal passage has already been referred to. A temporarily engorged turbinated body might be compressed by a convexity of the septum or by a spur sufficiently to affect its growth, or in the concave side, meeting no resistance, it might be stimulated to increased growth. This might be communicated to the ethmoid cells, so that they also would take part in the process. If we accept this as a sufficient explanation, we must acknowledge that the ethmoid and turbinated bones are especially endowed with a very sensitive nutritive adaptability.

Baumgarten, Woakes, Seiler, and others have suggested that the deviation of the septum may be secondary to the enlargement of the turbinates. This view seems to have many arguments against it. It is hard to see why the turbinated bones of the two sides should so act in harmony; neither is it likely that a part of a lower turbinated bone receding from a spur should be the cause and not the effect of the spur. Also, the septum is especially liable to deformity anterior to the turbinated bones, where the external nasal walls are symmetrical and unyielding. Cases of atrophic rhinitis may present deviations, although the type of face in which ozæna most frequently occurs is that in which asymmetry of the fossæ is least common. That an abnormally large middle turbinate may deflect the septum, and this in turn cause a retraction of the middle turbinate and ethmoid cells of the opposite side, is suggested by Zuckerkandl in connection with one of his plates.

It has also been suggested by Welcker, Ziem, Schaus, and others that neither of the deformities is secondary to the other, but that both are the result of a general asymmetry of the whole region. Bosworth, commenting on the observation of Schaus, speaks of "scoliosis, as it were, of the whole face." Ingals, in 1882, showed a relationship between deviations of the external nose and of the septum. These irregularities either first appear or are much increased during the growth of the intranasal structures at about the time of puberty. Walsham says briefly: "The vomer is pushed downward and forward by the rostrum of the sphenoid, carrying with it the perpendicular plate of the ethmoid, together with the nasal bones and the external table of the frontal, to which these are attached. If anything interferes with this forward extension it will cause deviation of the septum."

Whatever the mechanism may be by which one intranasal structure is modified to fit another, there seems to be no doubt but that nature has some method by which the air-carrying capacity of the two sides can be kept approximately equal. The following, from Sir James Paget, quoted by Delavan, seems appropriate here: "Hypertrophy of bone presents itself in many interesting cases. It is usually a secondary process, ensuing in consequence of change in a part with which some bone is intimately connected. Just as in their natural development and growth the bones of the skull are formed in adaptation to the brain, and those of the limbs are framed to a fitness of the action of the muscles, so in disease they submit in their nutrition to adapt themselves to the more active parts." As the function of the nose is to transmit and modify air, should we not expect to find the bones adapting themselves to this function?

The delicate physiological balance of the nasal organ is well known. The size and shape of the air-carrying passages in the nose are of the greatest importance for its proper physiological functions. This physiological balance would be entirely destroyed by a deviation of the septum unless a corresponding anatomical balance were established. As can be seen on a cross-section through symmetrical nasal chambers, even a slight deflection of the septum would open one passage and narrow the other, so that a large proportion of the air would go through one side. May we not assume, then, that if asymmetry is present in one structure, asymmetry of neighboring structures must be looked upon as physiological rather than as pathological? In other words, these secondary changes subtract from rather than add to the departure from typically perfect conditions.

In a nasal cavity in which this adjustment has not taken place, where, for instance, a turbinate opposite a concavity is small, leaving a wide passage, there is always present some pathological change, or at least a disturbance of function. Also, in the opposite or narrowed cavity, unless the turbinate recedes, there must necessarily be an appreciable obstruction to the passage of air. The greater the deviation the more the nasal passages become defective as an organ for respiration. Compensatory shrinking is limited on the convex side, and the hypertrophy of the concave side often becomes excessive. In front of the turbinates, where the cartilaginous septum may bend toward an unyielding nasal process of the superior maxilla, there can be no readjustment, and a sufficient deflection of the septal cartilage causes a unilateral obstruction perfectly obvious to the patient. Many cases of obstruction requiring operative interference, and most of the methods for straightening the septum come under this head. The object of these operations is to open a passage into the nasal cavity proper.

So well is the function maintained that most persons with deviating septa, provided the deviation is not so far forward as to block the passage anterior to the turbinates, are unable to tell which nasal cavity has the greater capacity, and no one, surely, is surprised to find many asymmetrical nasal passages in persons who never have the slightest trouble with their noses.

Turning briefly to the practical bearing of these large turbinates where, on account of obstruction to breathing or for other cause, it is advisable to straighten the passages, we are told by some of the writers whom I have quoted that the large turbinate should be reduced before the septum is straightened, by others that nature's process of readjustment will be sufficient to take care of the redundancy of the turbinate. My belief is that there is truth in both assertions, each in its proper case. To one rule of treatment I think that there will be no question. A turbinated body should be judged by the distance between it and the septum, and not by its absolute size.

In closing, I would present the following propositions for discussion :

1. In cases of deviation of the septum, the common asymmetries of the other intranasal structures should be classed as physiological compensatory changes.

2. As a rule, these changes in the turbinated bodies and ethmoid bone are not due to increase or diminution of the air current. Neither is the deflection of the septum often secondary to asymmetrical turbinates.

3. Whatever may be the mechanism which underlies this adjustment, the ethmoid and the turbinated bones are especially endowed with nutritive adaptability, and in consequence are able to minimize the disturbance which a deflecting septum would produce. Slight deflections are often rendered entirely innocuous, more extensive ones partially so.

4. The entrance into the nasal cavities proper cannot share in this readjustment, and here a deflection of the cartilage of the septum soon becomes obstructive.

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A CASE OF ACUTE LEUKÆMIA PRESENTING SOME INTERESTING FEATURES.[1]

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The accompanying case might not be deemed worthy of report because of the incompleteness of the record were there not very special features of interest that demand its publication. The patient was in the writer's wards of the Episcopal Hospital, in the spring of 1899, for thirty days prior to her death.

She was admitted with symptoms which, several inspections of the blood showing evident leukopænia, caused the diagnosis of scurvy to be made. These were: Spongy, hemorrhagic gums, with looseness of the teeth, fetid breath and furred tongue, an anæmic appearance, and a tendency to nose-bleed. The patient had been debilitated since the birth of her last child, three months before, and the above symptoms had since developed. Appropriate treatment for scorbutus was ordered, and but little further attention was paid to the case until she was well into what appeared to be an attack of typhoid fever.

The history is as follows:

Ann S., aged twenty-eight years; birthplace, Philadelphia; occupation, housework. Admitted to the Episcopal Hospital on April 11, 1899. Died on May 11, 1899.

Family History. Father said to have died of heart disease; mother of insanity. Otherwise, family history negative.

Previous History. Had measles when a child. No other infectious disease. Fairly healthy until lately, save that she had had a bad diarrhœa after the birth of one of her children. No specific history; never had had chills and fever. Married for nine years; five children; last child born three months before admission. Had nursed child for one

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[1] Read before the Association of American Physicians, 1901.